

CH451: CHEMICAL REACTION ENGINEERING – II

CREDITS = 6 (L = 4, T=0, P = 2)

1. **HETEROGENEOUS REACTIONS:** adsorption, physisorption and chemisorption, Langmuir and Freundlich adsorption isotherm, B.E.T equation, Langmuir and Hinshelwood rate equations for solid catalyzed gas reactions; external and internal transport processes. Effectiveness factors for heterogeneous reactions; Gas - solid catalytic reactor design, isothermal and non - isothermal conditions, fluidized bed reactors, slurry and trickle bed reactors; thermal stability of reactors; novel reactors. 12 Hours
2. **NON-CATALYTIC GAS-SOLID REACTIONS:** - Ash diffusion, Gas film and reaction control regimes; evaluation of kinetic rate in different regimes; flow pattern and design of gas-solid reactors like packed bed, fluid bed, moving bed reactors 10 Hours
3. **FLUID-FLUID REACTIONS:** kinetics and controlling regimes; film conversion parameter, kinetic regime determination from solubility and experiments; design of towers for fast and slow reactions. Selection of Equipments for Gas-liq reactions. 8 Hours
4. **CATALYST DEACTIVATION:** mechanism and rate of catalyst deactivation, experimental determination catalyst decay; parallel, series and side-by-side deactivation of catalyst; application of decay kinetics in design. 10 Hours

REFERENCE BOOKS

Title: Chemical Reactions Engineering
Author: Octave Levenspiel
Publisher: Wiley Eastern

Title: Chemical Engineering Kinetics - 2nd ed
Author: J M Smith
Publisher: Mc Graw Hill

Title: Elements of Chemical Reaction Engineering
Author: Fogler. H
Publisher: PHI

LIST OF EXPERIMENTS

- 1 To determine the mass transfer coefficient (K_{Ga}) on the gas side for the system of air and CO_2 reacting with buffer solution

and further evaluating the concentration differences over a period of time from the mass transfer rate in bubble contactor.

2. To determine the mass transfer coefficient ($K_G a$) on the gas side for the system of air and CO_2 reacting with buffer solution and further evaluating the concentration differences over a period of time from the mass transfer rate in agitated bubble contactor.
3. To determine the mass transfer coefficient for a given heterogeneous liquid - liquid reaction in a stirred cell.
4. To determine the enhancement factor for mass transfer with and without reaction in heterogeneous system.
5. To study the kinetics of oxidation of sodium sulphite in an agitated bubble contactor by passing air through it.
6. To study the kinetics of the reaction between ethyl acetate and sodium hydroxide in a stirred cell by differential method of analysis.
7. To study the kinetics of the reaction between ethyl acetate and sodium hydroxide by half life method in a stirred cell.
8. To study the kinetics of the reaction between ethyl acetate and sodium hydroxide conducted in a heterogeneous as well as in homogeneous manner.